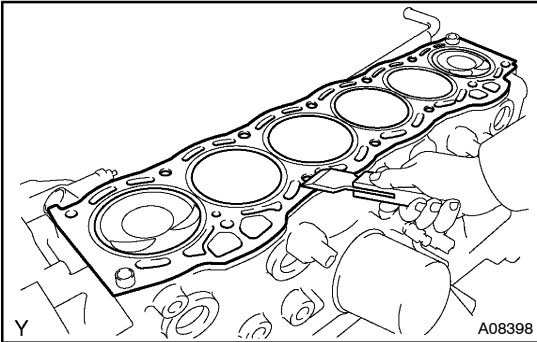


INSPECTION

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

- (a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the top surface of the piston.



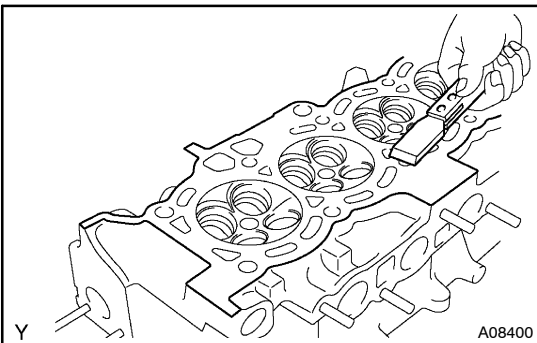
- (b) Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

- (c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION:

Protect your eyes when using high-pressure compressed air.

2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS (See page EM-89)

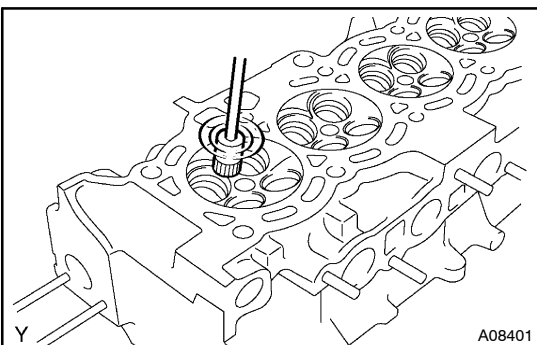


3. CLEAN CYLINDER HEAD

- (a) Using a gasket scraper, remove all the gasket material from the contact surface of the cylinder block.

NOTICE:

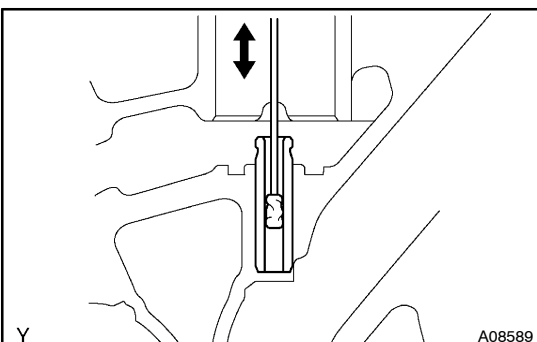
Be careful not to scratch the cylinder block contact surface.



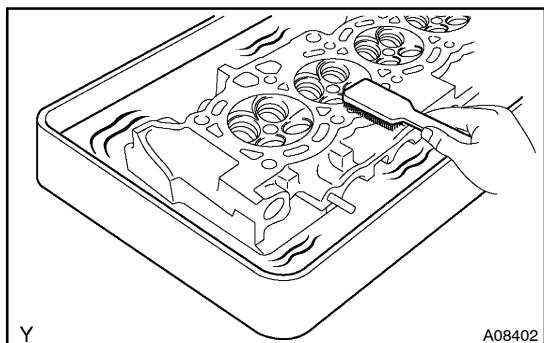
- (b) Using a wire brush, remove all the carbon from the combustion chamber.

NOTICE:

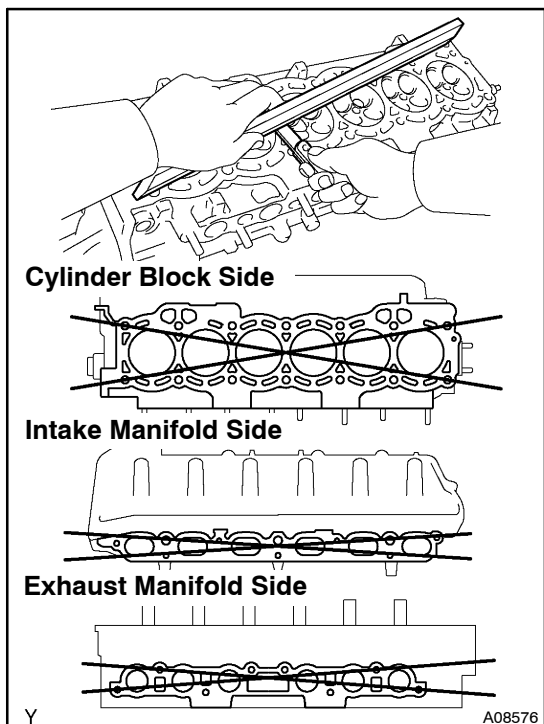
Be careful not to scratch the cylinder block contact surface.



- (c) Using a valve guide bushing brush and solvent, clean all the guide bushings.



- (d) Using a soft brush and solvent, thoroughly clean the cylinder head.



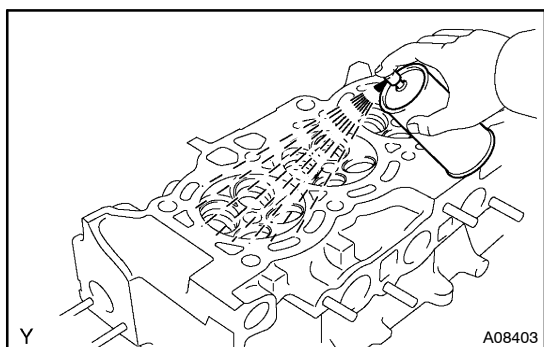
4. INSPECT CYLINDER HEAD

- (a) Inspect for flatness.
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

Maximum warpage:

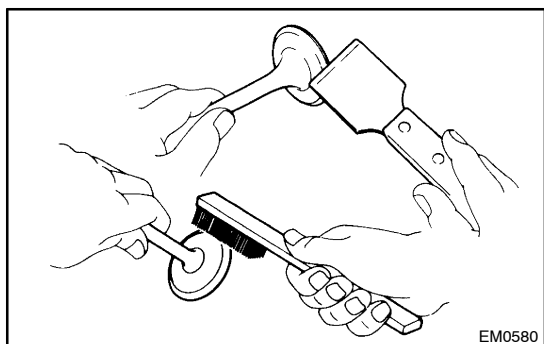
Cylinder block side	0.20 mm (0.0079 in.)
Intake manifold side	0.20 mm (0.0079 in.)
Exhaust manifold side	0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the cylinder head.



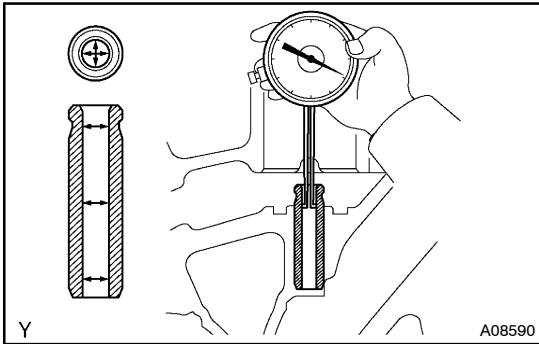
- (b) Inspect for cracks.
Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



5. CLEAN VALVES

- (a) Using a gasket scraper, chip off any carbon from the valve head.
(b) Using a wire brush, thoroughly clean the valve.

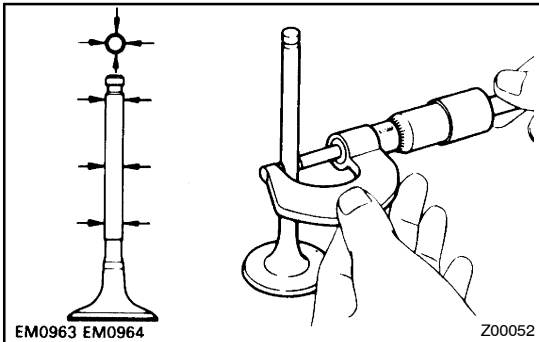


6. INSPECT VALVE STEMS AND GUIDE BUSHINGS

- (a) Using a caliper gauge, measure the inside diameter of the guide bushing.

Bushing inside diameter:

5.010 – 5.030 mm (0.1972 – 0.1980 in.)



- (b) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

Intake	4.970 – 4.985 mm (0.1957 – 0.1963 in.)
Exhaust	4.965 – 4.980 mm (0.1955 – 0.1961 in.)

- (c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

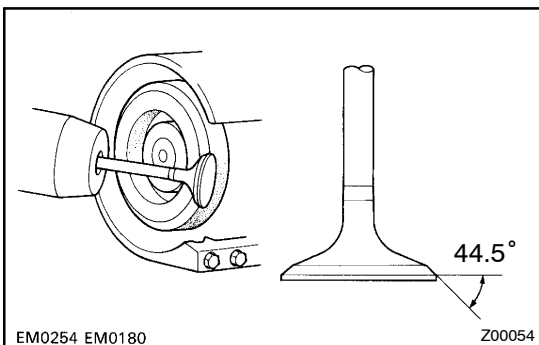
Standard oil clearance:

Intake	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust	0.030 – 0.065 mm (0.0012 – 0.0026 in.)

Maximum oil clearance:

Intake	0.08 mm (0.0031 in.)
Exhaust	0.10 mm (0.0039 in.)

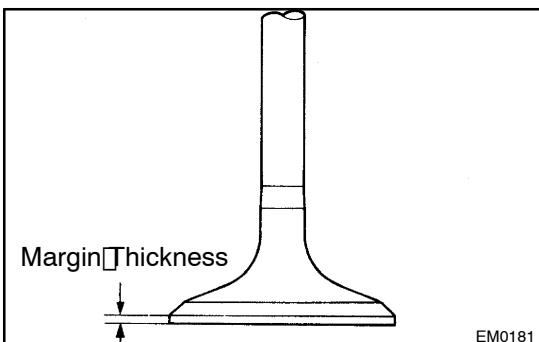
If the clearance is greater than maximum, replace the valve and guide bushing. (See page EM-53)



7. INSPECT AND GRIND VALVES

- (a) Grind the valve enough to remove pits and carbon.
 (b) Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°



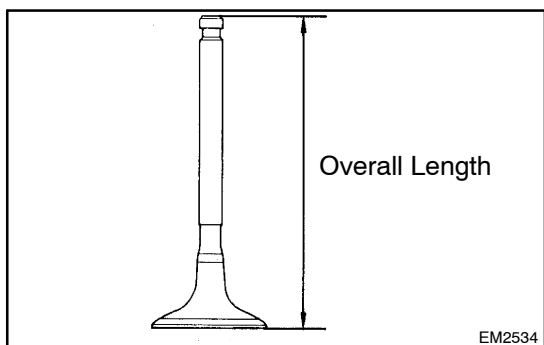
- (c) Check the valve head margin thickness.

Standard margin thickness:

Intake	0.8 mm (0.0315 in.)
Exhaust	1.0 mm (0.0394 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

If the margin thickness is less than minimum, replace the valve.



- (d) Check the valve overall length.

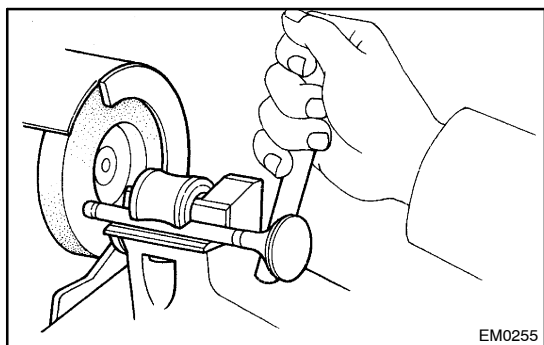
Standard overall length:

Intake	91.75 mm (3.6122 in.)
Exhaust	91.79 mm (3.6138 in.)

Minimum overall length:

Intake	91.25 mm (3.5925 in.)
Exhaust	91.29 mm (3.5941 in.)

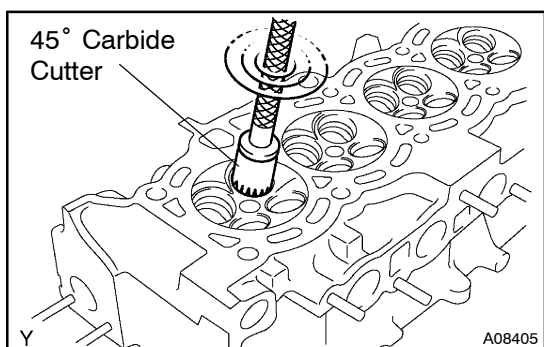
If the overall length is less than minimum, replace the valve.



- (e) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

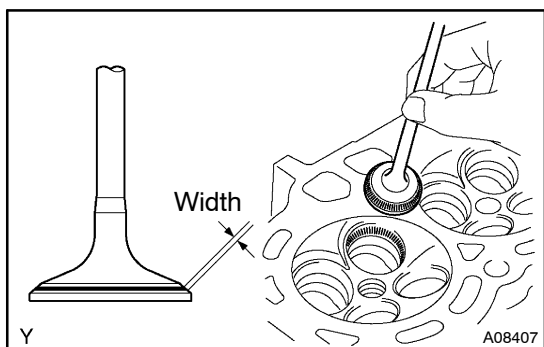
NOTICE:

Do not grind off more than the minimum length.



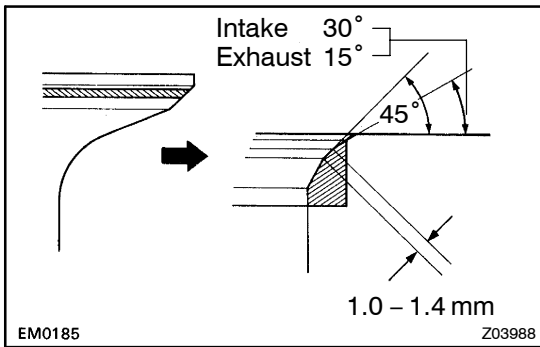
8. INSPECT AND CLEAN VALVE SEATS

- (a) Using a 45° carbide cutter, resurface the valve seats.
Remove only enough metal to clean the seats.



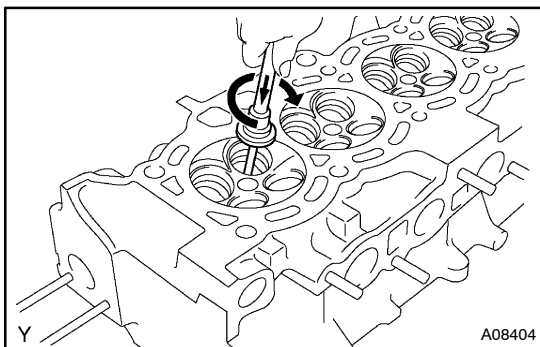
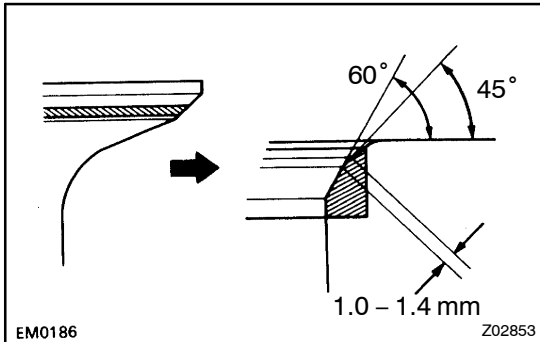
- (b) Check the valve seating position.
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.
- (c) Check the valve face and seat for the following:
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
 - If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
 - Check that the seat contact is in the middle of the valve face with the following width:

1.0 – 1.4 mm (0.039 – 0.055 in.)

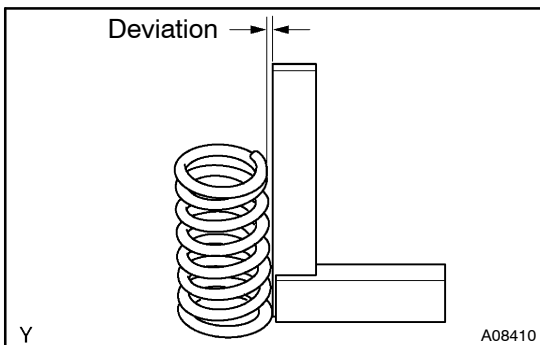


If not, correct the valve seats as follows:

- (1) Intake:
If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.
- (2) Exhaust:
If the seating is too high on the valve face, use 15° and 45° cutters to correct the seat.
- (3) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



- (d) Hand-lap the valve and valve seat with an abrasive compound.
- (e) After hand-lapping, clean the valve and valve seat.

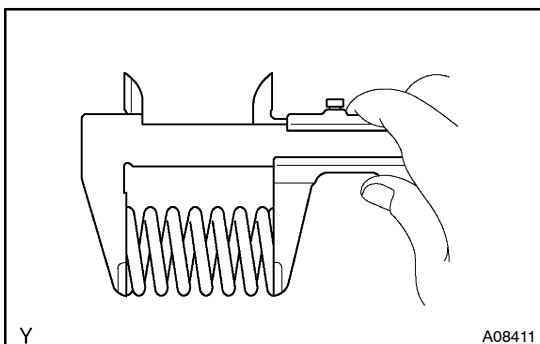


9. INSPECT VALVE SPRINGS

- (a) Using a steel square, measure the deviation of the valve spring.

Maximum deviation: 2.0 mm (0.079 in.)

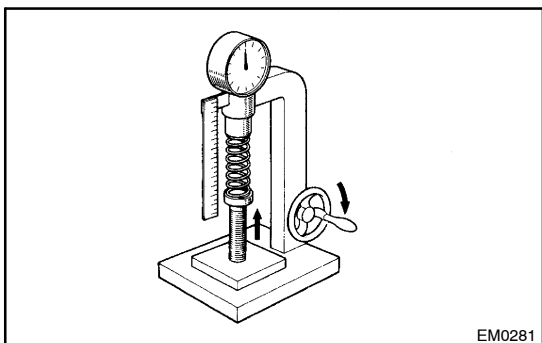
If the deviation is greater than maximum, replace the valve spring.



- (b) Using a vernier caliper, measure the free length of the valve spring.

Free length: 47.3 mm (1.862 in.)

If the free length is not as specified, replace the valve spring.



EM0281

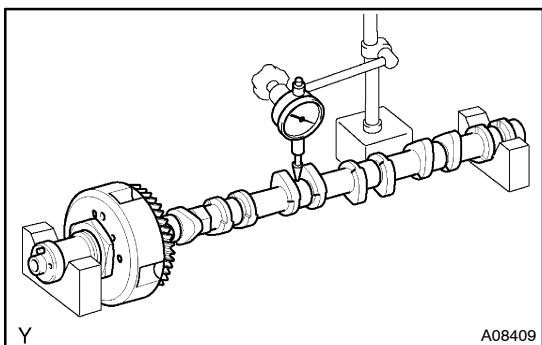
- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

188 – 204 N (19.2 – 20.8 kgf, 42.3 – 45.9 lbf)

at 33.5 mm (1.319 in.)

If the installed tension is not as specified, replace the valve spring.



A08409

10. INSPECT CAMSHAFTS AND CAMSHAFT TIMING GEAR (VVT-i)

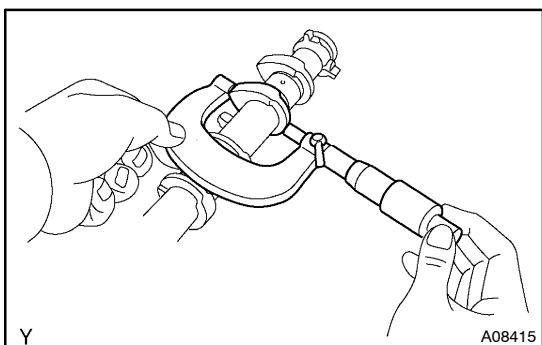
- (a) Inspect the circle runout.

(1) Place the camshaft on V-blocks.

(2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.06 mm (0.0024 in.)

If the circle runout is greater than maximum, replace the camshaft.



A08415

- (b) Using a micrometer, measure the cam lobe height.

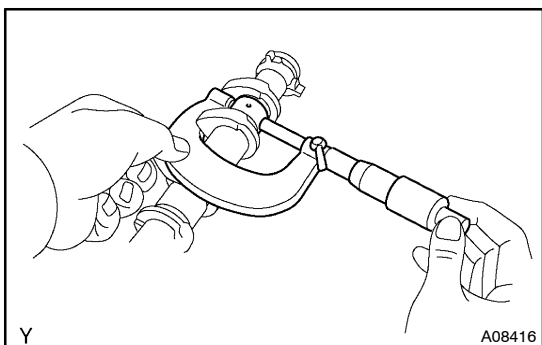
Standard cam lobe height:

Intake	46.75 – 46.85 mm (1.8405 – 1.8445 in.)
Exhaust	46.27 – 46.37 mm (1.8216 – 1.8256 in.)

Minimum cam lobe height:

Intake	46.6 mm (1.8346 in.)
Exhaust	46.1 mm (1.8150 in.)

If the cam lobe height is less than minimum, replace the camshaft.



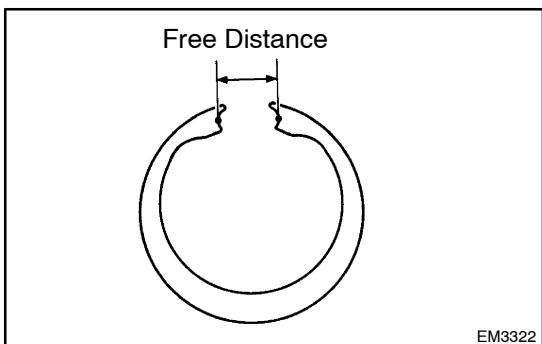
A08416

- (c) Using a micrometer, measure the journal diameter.

Journal diameter:

26.959 – 26.975 mm (1.0614 – 1.0620 in.)

If the journal diameter is not as specified, check the oil clearance.

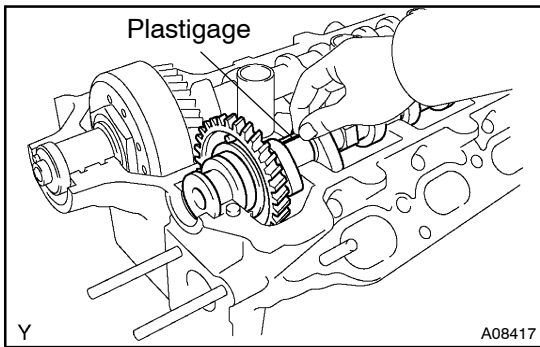


EM3322

- (d) Using vernier calipers, measure the free distance between the gear spring ends.

Free distance: 17.6 – 18.2 mm (0.693 – 0.717 in.)

If the free distance is not as specified, replace the gear spring.



(e) Inspect the journal oil clearance.

(1) Clean the bearing caps and camshaft journals.

(2) Check that bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

(3) Place the camshafts on the cylinder head.

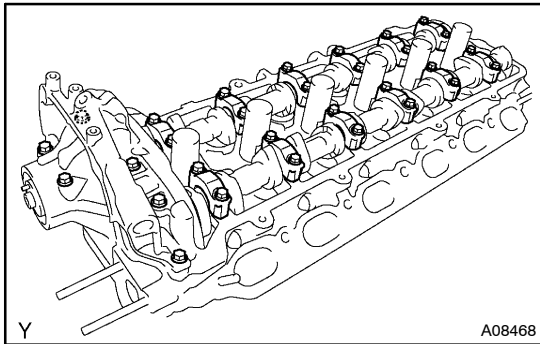
(4) Lay a strip of Plastigage across each of the camshaft journals.

(5) Install the bearing caps. (See page EM-59)

NOTICE:

Do not turn the camshaft.

(6) Remove the bearing caps.



(7) Measure the Plastigage at its widest point.

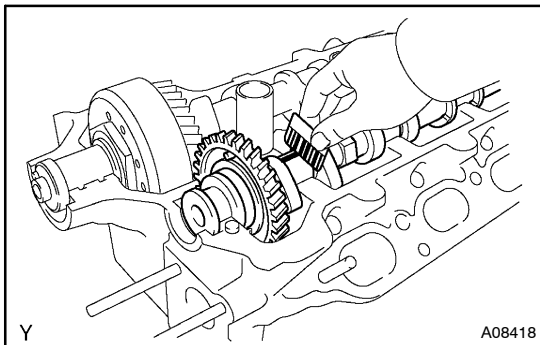
Standard oil clearance:

0.025 – 0.062 mm (0.0010 – 0.0024 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(8) Completely remove the Plastigage.



(f) Inspect the camshaft thrust clearance.

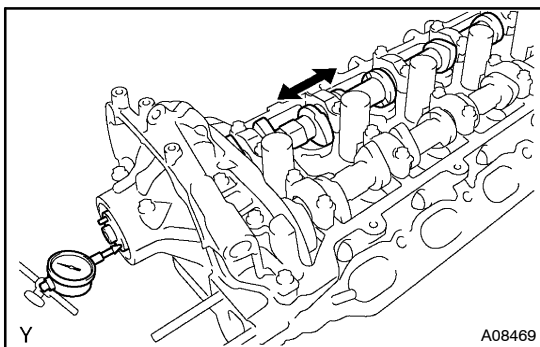
(1) Install the camshaft. (See page EM-59)

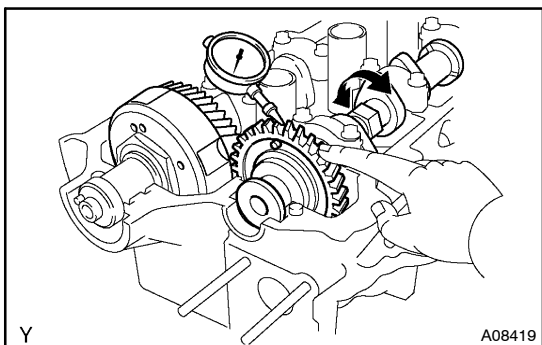
(2) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:

Intake	0.045 – 0.100 mm (0.0018 – 0.0039 in.)
Exhaust	0.045 – 0.110 mm (0.0012 – 0.0043 in.)

If the thrust clearance is not as specified, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.





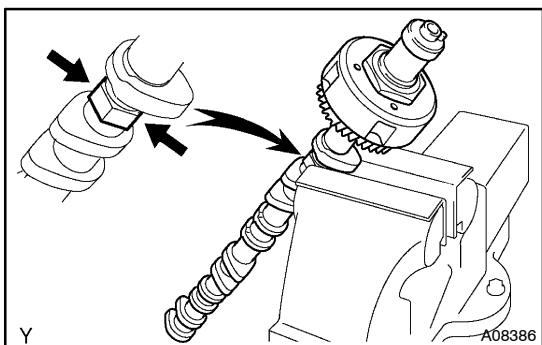
- (g) Inspect the camshaft gear backlash.
- (1) Install the camshafts without installing the intake cam sub-gear. (See page EM-59)
 - (2) Using a dial indicator, measure the backlash.

Standard backlash:

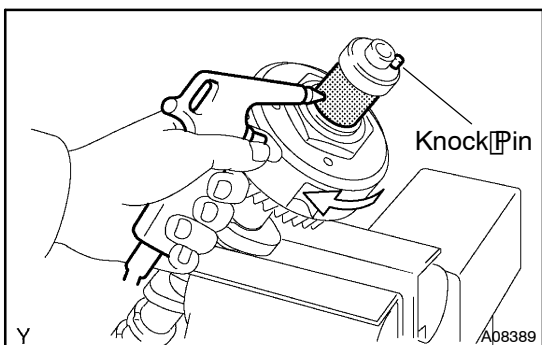
0.020 - 0.200 mm (0.0008 - 0.0079 in.)

Maximum backlash: 0.30 mm (0.0188 in.)

If the backlash is greater than maximum, replace the camshafts.



- (h) Inspect the camshaft timing gear (VVT-i) operation.
- (1) Mount the hexagon wrench head portion of the exhaust camshaft in a vise.
 - (2) Check that camshaft timing gear (VVT-i) will not turn.



- (3) Cover the port except the port on the advance angle side shown in the illustration with the vinyl tape.
- (4) Using an air gun, apply about 100 kPa (1 kgf/cm³, 14 psi) of air pressure to the port on the advance side.

NOTICE:

When the oil is splashed, wipe it off with a shop rag and the likes.

HINT:

Perform this in order to release the lock pin for the maximum delay angle locking.

- (5) Under the condition of (4), turn the camshaft timing gear (VVT-i) to the advance angle side (the white arrow marked direction in the illustration) with your hand.

Standard: Must turn

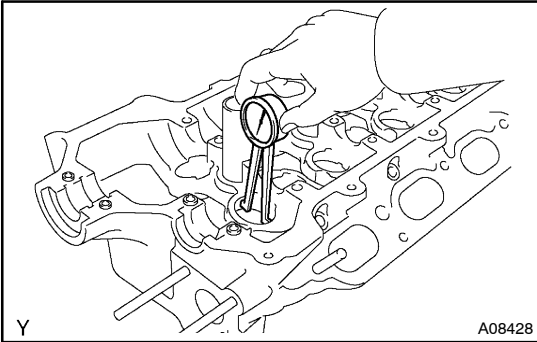
HINT:

Depending on the air pressure, the camshaft timing gear (VVT-i) will turn to the advance angle side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.

- (6) Except the position where the lock pin meets at the maximum delay angle, let the camshaft timing gear (VVT-i) turn back and forth and check the movable range and that there is no disturbance.

Standard: Movable smoothly in the range about 25°

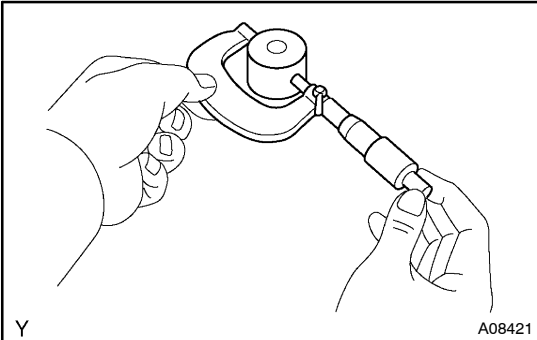
- (7) Turn the camshaft timing gear (VVT-i) with your hand and lock it at the maximum delay angle position.

**11. INSPECT VALVE LIFTERS AND LIFTER BORES**

- (a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter:

31.000 – 31.025 mm (1.2205 – 1.2215 in.)



- (b) Using a micrometer, measure the lifter diameter.

Lifter diameter:

30.966 – 30.976 mm (1.2191 – 1.2195 in.)

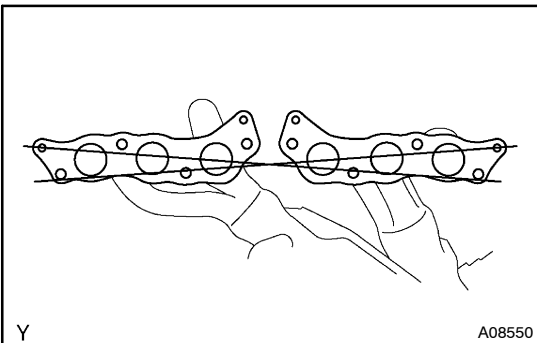
- (c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Standard oil clearance:

0.024 – 0.059 mm (0.0009 – 0.0023 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

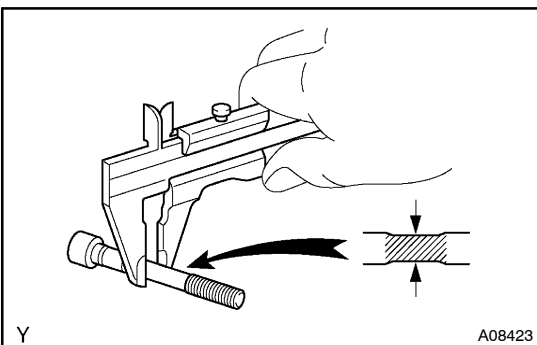
If the oil clearance is greater than maximum, replace the lifter. If necessary, replace the cylinder head.

**12. INSPECT EXHAUST MANIFOLD**

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage: 0.70 mm (0.0276 in.)

If warpage is greater than maximum, replace the manifold.

**13. INSPECT CYLINDER HEAD BOLTS**

Using vernier calipers, measure the tension portion diameter of the bolt.

Standard outside diameter:

8.7 – 8.8 mm (0.343 – 0.346 in.)

Minimum outside diameter: 8.6 mm (0.339 in.)

If the diameter is less than minimum, replace the bolt.